# Intelligent Disease Detection in Tomato Leaves Using Dense Neural Networks

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**ABSTRACT**

Grain Production is the most significant field.Many Nations have taken steps to restrict the grain exports as COVID-19 expanded all over the world.one of the major concern affecting economies today is how to increase grain output.Crop diseases are a challenging issue for farmers,though,it’s crucial to understand their severity as soon as possible in order to assist staff in taking additional steps to prevent further plant infection. A Restructured residual dense network was proposed for tomato leaf disease identification;this hybrid deep learning model combines deep residual networks and dense networks,which improves the flow of information and gradients while reducing the number of training process parameters to increase computation accuracy.On the Tomato test dataset,experimental findings demonstrate that this model can reach top-1 average identification accuracy of 95%,the RDN model may outperform the majority of state-of-the-art model by considerable margin using less computing power to attain superior results.

**Keywords:** Residual Dense Network, Flow of gradients, Deep Learning, State-of-the-art-model.

## I. INTRODUCTION

In March 2020,a joint statement by the Director General of FAO,WHO and WTO, as countries move to enact measures aiming to halt the accelerating COVID-19 pandemic, every country must take measures to ensure food Security. Food Security has been increasingly addressed; many countries and institutions are working to increase food production. How to master crop diseases and insect pests more accurately and effectively is an important research area. In Particular, crop development and productivity are significantly impacted by leaf diseases, researches have put in a lot effort.

Currently, there are two primary areas of focus for crop disease identification .One is the conventional computer vision approach, which primarily uses feature extraction and spectral detection to diagnose various illnesses. Diverse disease kinds result in diverse leaf characteristics, which cause healthy crops and disease-erode leaves to have different forms and hues. The second topic recognizes photos of leaves using machine learning technologies. In other words, supervised or unsupervised learning algorithm, a are used to identify disease photos, and the various characteristics of healthy and disease d plants are used to carry out the recognition.

With Development of Machine learning and IoT which automatically identifies plant diseases especially for deep learning to identify accuracy are sufficiency of crop leaf disease such as:

1. Bacterial Spot.

2. Early Blight.

3. Leaf Mold

4. Septoria Leaf Spot

5. Yellow Leaf Curl Virus.

This method also introduces an image collection. Image Preprocessing, Segmentation and classification method based on deep learning task of automatic plant disease detection and classify crop disease In Agriculture. For training, this model created photos of four distinct leaf diseases. It then combined Dense Net and instance normalization to distinguish between authentic and fraudulent disease images and to extract features about tomato leaf lesions. Lastly, a deep regret gradient penalty was used to stabilize the training process. The findings demonstrated that the overfitting issue in illness identification can be successfully resolved by the GAN-based data augmentation strategy, which can also significantly increase identification accuracy.

A deep neural network built on an end-to-end plant disease diagnosis model that is capable of accurately classifying plant diseases and types. This model is made up of two parts: the leaf segmentation part, which separates the original image's leaves from background, and the plant disease classifier, which uses features from several well-known pre-trained models to classify plant diseases. The plant disease classifier is based on a two-head network. According to experimental results, this approach can reach an accuracy of 0.8745 in illness recognition and 0.9807 in plant classification.

## II. METHODOLOGIES

**Modules Description:**

**Data Collection:**

This is the first module; we developed the system to get the input dataset for the training and testing purpose. We give the data set in model folder.

**Dataset:**

The dataset consists of 13,918 Tomato Leaf Disease images.

**1. Bacterial Spot:** *(Xanthomonas)*Leading to dark, water-soaked spots on leaves.

**2. Early Blight:** *(Alternaria solani)*Resulting in brown concentric ring spots on leaves.

**3. Leaf Mold:** *(passalora fulva)* yellow spots on the upper leaf surface and grayish mold on the underside.

**4. Septoria Leaf Spot:**(*septoria lycopersic* )marked by small, circular, darkspots with light centre

**5. Yellow Leaf curl Virus:** *(whiteflies)* yellowing, curling, and stunting of leaves.

**Importing Necessary libraries:**

We will be using python language and import necessary libraries such as keras for building the main model, sklearn for splitting the training and test data, PIL for converting the images into array of numbers such as pandas, numpy, matplotlib and tensorflow.

**Building Model:**

Convolutional Neural networks (CNNs) are highly effective in image recognition due to their convolution operations, which scan images for features using parameters like stride and padding. Features are progressively identified across layers, from basic patterns to high-level representations, with non-linear activation (ReLu) applied after convolution. Pooling layers reduce dimensions, and the final convolution output is flattened and passed through fully connected layers, ending with a soft max layer for classification. In this project,VGG-16 model, with two convolution layers, was used for feature extraction and image classification.

## III. LITERATURE REVIEW

**Title**: "Adaptive weather conditions based IoT enabled smart irrigation technique in precision agriculture mechanisms"

**Authors:** B.Keswani, A.G.Mohapatra, A.Mohanty, A.khanna, J.J.P.C.Rodrigues, D.Gupta, and V.H.C. de Albuquerque.

**Year:** 2019

**Description:**

Precision agriculture integrates IoT-enabled wireless sensor networks to monitor real-time farm data like soil moisture, temperature, humidity, and CO2 levels for efficient farming. It uses neural-based predictions and structural similarity (SSIM) to optimize irrigation. By managing water values in deficient areas. Comparative optimization techniques enhance soil moisture prediction and mapping. A fuzzy logic based weather model refines valve controls, ensuring farming with minimal environment impact.

**Title:** "Classification of plant diseases using machine learning and image preprocessing techniques"

**Author:** P. Sharma, P.Hans, and S.C.Gupta.

**Year:** 2020

**Description:**

Agriculture significantly influences a country's growth, with 65% of India's population dependent on it. Plant diseases, often starting on leaves, affect crop quality and quantity, making manual detection in large forms challenging. This paper proposes an AI-based system for automatic plant leaf disease detection and classification. Using steps like image collection, preprocessing, segmentation, and classification, the system enables quick diagnosis and remedies, aiming to enhance agricultural productivity.

## IV. SYSTEM ARCHITECTURE

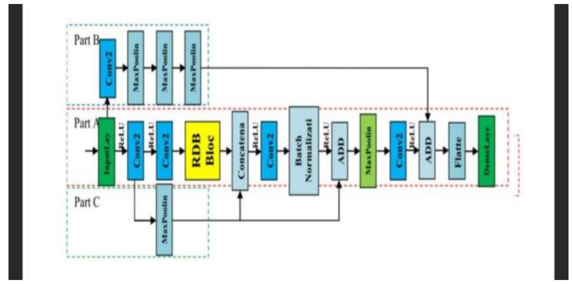


**Fig:** System Architecture

## V. RESULTS

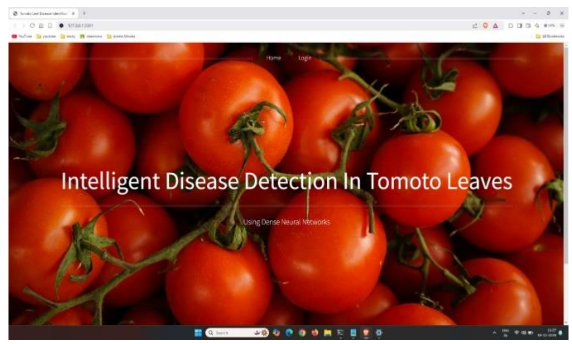


Fig: Disease detection welcome page

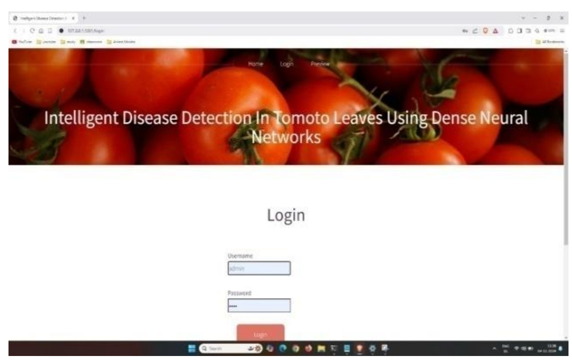


Fig: User login page

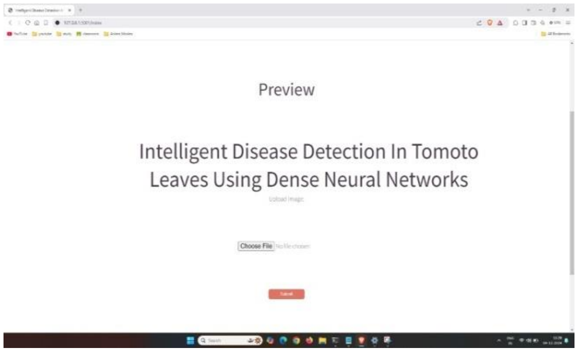


Fig: Choose a file to upload

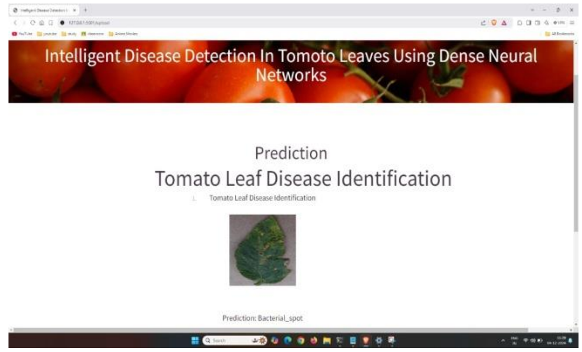


Fig: Disease Prediction

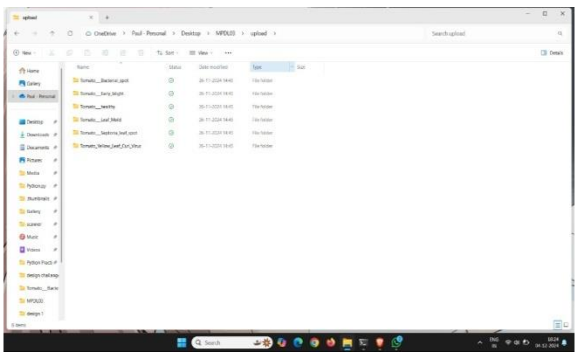

Fig: Select the data

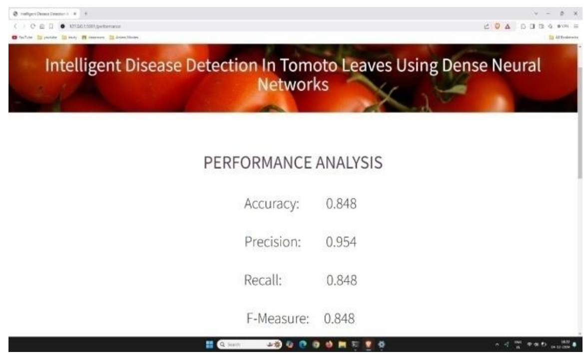


Fig: Performance analysis

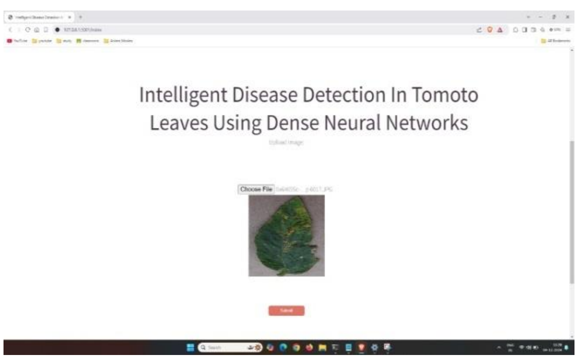


Fig: Image Uploaded

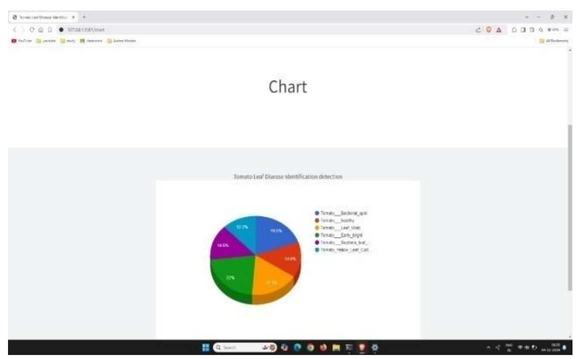


Fig: pie chart representation

## VI. CONCLUSION

Tomato is a very popular food worldwide for food or for seasoning; it is one of the necessities of life. To produce better quality tomatoes, people must overcome the problem of plant diseases. Generally, plant diseases appear on the leaves first, which makes the leaf disease identification particularly important. This paper proposed a VGG Architecture model based tomato leaf disease identification model; this inspiration came from

RDN model in the super resolution task. By adjusting the model architecture, we transformed it into a classification model, which obtained a higher accuracy than state-of-the- art model.

## VII. FUTURE ENHANCEMENT

Integrating the advanced deep-learning techniques such as Transformer-based models or Convolutional Neural networks with attention mechanism to improve prediction accuracy further. Additionally, incorporating real-time IoT-enabled data collection from farms, such as environmental conditions, soil moisture, and weather data, could enhance the model's adaptability. Using Data mining techniques, clustering, and association rules, the system can also provide actionable insights for farmers, such as early warning systems for disease outbreak and optimized crop management recommendations.

## VIII. REFERENCE

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